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The Editor's Page

SUPPLEMENTARY to this issue is the subject and author index for Vol. VI. For more convenient reference and also to economize space, the format has been changed. Author and subject indices of complete research reports and articles start the index and are followed by their subject indices, and the latter by the subject index of abstracts. The author index of articles abstracted is omitted, not only to economize space and expense, but primarily because there is reasonably conclusive evidence that this abstract author index is seldom used. It has, however, been prepared as usual and can be referred to at the Secretary's office personally or by letter inquiry.

Chemical Cotton Classing

IN the scientific search for a satisfactory method of determining from a representative sample of cotton its quality and spinning value, it seems now to be agreed that microscopic methods are impractical. Microscopic, or even photomicrographic, examination of the hundreds or thousands of single fibres of what has been generally accepted as a representative sample is a time-consuming job, and the trend now is toward the use of much larger samples. An alternative method of interesting possibilities was suggested by Dr. Carl M. Conrad, senior cotton technologist, Bureau of Agricultural Economics, in a paper presented before Committee D–13 of the A. S. T. M., which is published complete in this issue. This chemical method, if perfected, would provide an adequate solution of the problem of representative sampling. While there is a dearth of scientific knowledge as to correlation of physical and chemical properties of raw cotton, Dr. Conrad holds that their correlation in yarns is definitely indicated. He also notes that the Chandler bundle method for determining cotton strength also gives good correlation between cotton and yarn strength. While his findings are not conclusive they are a valuable contribution to the literature of the subject.

Also Physical Cotton Classing

ACCORDING to an article by Dr. Conrad in the *Daily News-Record* of Jan. 22, the laboratory of the Division of Cotton Marketing, Bureau of Agricultural Economics, under the direction of Dr. R. W. Webb, principal cotton technologist, is alive to the possibility of developing other physical methods than microscopy for determining the spinning value of cotton from a representative sample. Commenting upon the use of X-ray photography for this purpose Dr. Conrad writes: "Not only is there evidence that strength may be indicated by X-ray analysis, but it is possible that the average number of convolutions per unit of length of cotton fibre in a sample can be determined at the same time and from the same photographs."

THE research on the chemistry of cellulose that is sponsored at the Boyce Thompson Institute for Plant Research by The Chemical Foundation, and is under the direction of Dr. Wanda K. Farr, involves not only chemical but physical properties of cotton. Associated with Dr. Farr is Dr. Wayne A. Sisson, who worked as a Fellow of The Textile Foundation under Prof. G. L. Clark at the University of Illinois on the X-ray Analysis of Textile Fibres, and is now engaged on X-ray work on cellulosic materials. Eventually the results of these studies should provide the basic information that should indicate correlation between chemical and physical properties of cotton.

* * *

ANTEDATING the previously mentioned efforts to discover a practical method for determining the spinning value of cotton from a representative sample, is a privately conducted research which is based upon the electrical conductivity of groups of cotton fibres. As a sample of any desirable size can be used there can be no question of ability to prepare a sample of representative character, but there are other problems involved that have protracted the study. Undoubtedly maintenance of uniform regain in each sample is a vital and difficult problem. Another probably is correlation of test results of a given sample with estimates of its spinning value by skilled classers. This particular apparatus is now receiving a mill test, but even if proved successful its principal use will be as a check on the classer's decision; not as a substitute for the classer.

Capitalizing Research

THE "Textile Research Issue" of the *Daily News-Record* is historically significant, as well as being a notable example of trade journalism. It is historically significant because it marks the first issue of a textile trade paper in which there is reflected in the special articles general acceptance of research by the industry, and, more important still, noteworthy acceptance by the trade of the opportunity to advertise their research accomplishments. It costs nothing to speak or write of research as a worthy undertaking, but when as large a number of manufacturers and merchants, as are numbered in the advertising pages of this Jan. 21st special issue of the *Daily News-Record*, spend their good money to inform their customers and prospective customers that they are operating upon a research basis and are offering products of research, there is definite historical proof that the industry is embarked in a scientific era. U. S. Institute and other research organizations of the industry have always had the benefit of liberal support by the *Trade Press*, and now that there is such general acceptance of the value of research by the industry it is to be hoped that they will all be able to capitalize it profitably.

A Textile Research Symposium

A SYMPOSIUM on textile research will be held as a part of the joint meeting of the American Physical Society and the Southeastern Section of this society in Chapel Hill, N. C., Saturday, Feb. 20. The symposium will emphasize the applications of physics in the textile field, and

all who are interested are cordially invited to attend, a special invitation being extended to members of U. S. Institute. Dr. A. R. Olpin, director of research, Kendall Mills, Paw Creek, N. C., represents the Southeastern Section on the program committee.

The program of invited papers is as follows: Structure of the Cotton Fibre, Dr. Wanda K. Farr, Cellulose Laboratory, Boyce Thompson Institute for Plant Research, Yonkers, N. Y.; Moisture Content and Electrical Properties of Cotton, A. C. Walker, Bell Telephone Laboratories, New York, N. Y.; Place of Statistics in Textile Research, John P. Elting, Kendall Mills, Paw Creek, N. C.; Physical Basis of Color Measurement, A. C. Hardy, Massachusetts Institute of Technology, Cambridge, Mass.

Another Triumph (?) of Science

THE late Arthur D. Little demonstrated that a purse could be made out of a sow's ear, and now some unidentified professor of chemistry at a university in this country is credited with having robbed assertive individuals of their once safe threat to eat their shirt if proved wrong. According to the *Manchester (Eng.) Guardian Commercial* the professor offered to eat his shirt if an assertion he had made was wrong, and did so when he was proved in error. We quote: "To perform this troublesome feat he first dissolved the shirt in acid, then neutralized the acid with another chemical, and proceeded to filter out all poisonous ingredients with a specially designed apparatus. Finally, his last operation was to spread the resultant pulp on a piece of bread and make a meal of it."

Can it be possible that the reference to the "poisonous ingredients" of the shirt is insidious British propaganda designed to injure the sale of domestic shirtings? At least it is a sufficient reason for the professor to remain incognito.

Sound Research Advice

"WHILST the textile industry possesses vigorous research associations, each firm should have its own scientific staff, if the best results are to be obtained. The central co-operative research associations should do mainly the long-distance research work which no industrial firm would be likely to undertake. Each firm should have persons capable of applying the results obtained by the central associations." This is the advice given by Sir Kenneth Lee, of Tootal Broadhurst Lee & Co., leading English manufacturers and practical exponents of both basic and applied textile research, in a recent lecture to the Bradford (Eng.) Textile Society.

Sir Kenneth also called attention to the "danger, now that industry is busier, that efforts to initiate research which may not produce results for some time may be relaxed. The present improved position should serve as an encouragement to spend capital as insurance against being left behind in the future. The present prosperity may easily prove to be fleeting, but it seems certain that if enough original research is done, Britain can achieve greater prosperity than ever before."

Cotton Quality Determination

By Application of Certain Chemical Methods*

By CARL M. CONRAD †

The Sampling Problem in Raw Cotton

THE physical testing of the natural textile fibres and their manufactured products, is attended by special difficulties. This is due in large part to the great variability which is so characteristic a property of materials of biological origin. It has well been said that of the approximately forty-five million fingerprints on file at the U. S. Bureau of Identification, no two have ever been found to be alike. It may be said with equal probability that of the approximately forty-five billion cotton fibres in a bale of cotton, no two are alike. Not only do the individual fibres differ from one another, but their various physical properties vary over an enormous range.

The significance of the above facts is perhaps not always appreciated. For one who has observed the easy and continuous flow of raw cotton in a cotton mill from the opener breaker through the various processes of manufacture to the final product in the form of yarn or fabric, there is little to suggest the heterogeneous nature of the material being employed. It is not until one attempts to measure the fibre properties of a single sample of cotton that he is confronted with serious difficulties. If he attempts to measure the length of the fibres, he finds that they vary from less than $\frac{1}{32}$ in. to as much as $2\frac{1}{2}$ to 3 inches. Nor are the different lengths present in equal quantities, but the quantity varies for each length in an incomprehensible fashion which varies more or less for each different sample examined. If we take some other cotton fibre property, say fineness, we find the same condition. Not only does the mean width of the ribbon vary from fibre to fibre, but it varies enormously from butt to tip along each single fibre. The thickness of the fibre wall, the orientation of the fibrillar strands, the degree of twist, the strength, each property in turn is found to display large and seemingly unrestrained variation.

Although the many properties of the fibres are so variable, the matter does not stop here,—at least in the case of cotton. If the fibres were randomly distributed in the mass, a small sample might be taken at almost any part and serve to represent the general batch. A small tuft may contain literally thousands of fibres. However, fibres of certain similar properties are more or less highly associated. For example, certain cotton seeds, as a result of disease or other damage, will have died before having

* Paper presented before Section I on Cotton of Subcommittee A–1 on Cotton and its Products, Committee D–13, A. S. T. M. meeting, New York, N. Y., Oct. 14–16, 1936.

† Senior Cotton Technologist, Bureau of Agricultural Economics, U. S. Department of Agriculture.

attained complete maturity. Examination of the fibres from such seeds will show that they likewise are poorly developed and "immature." In the process of ginning, a tuft of such fibres will be removed by a single saw tooth and, because of the clinging nature of the fibres, will remain associated throughout the conveying processes and rest together in the bale. In ordinary processes of sampling, improper proportions of such fibres will be taken and naturally will give rise to erroneous results. Other sources of similar association are location of the fibres on the seed, location of the seed in the lock, location of the boll on the plant, genetical and environmental variations. These associations of fibres are incompletely broken down in saw ginning and even less in roller ginning, and are retained to a greater or lesser degree in the bale.

In the manufacture of cotton, a number of the processes are designed to "break" the associations of like fibres; *i.e.*, to mix the cotton. First, it is generally customary to feed the opener breaker concurrently from a mix of a few to 100 or more bales. Then the successive breakers and pickers combine several series of laps and beat and partially separate the fibres. The card cleans, stretches, and disperses the fibres and discharges them in a very fine web, while in the drawing processes, numbers of slivers are combined, drawn and recombined. Obviously, these processes do remove a great deal of the association of fibres of like properties. However, it is more than probable that in the great attenuation that characterizes these processes, many of the associations are merely elongated or spread over a greater area, and, finally, are superimposed in the rovings and yarns to a greater or lesser degree. At any rate, it remains necessary in industrial and research work to test from 25 to 200 individual yarn skeins in order to attain appreciably stable averages. For the same degree of precision, in measuring the properties of raw cotton, literally hundreds of fibres must be tested.

One of the most serious problems in the physical testing of raw cotton, is mixing in such a way as to obtain representative samples. Mixing must be done without injury to the fibres, since obviously serious breakage would invalidate the length measurements; and similarly, serious abrasion, bending or scouring would reduce the value of the strength measurements. Furthermore, the clinging tendency of cotton fibres holds them to one another and they are separated and intermingled with the greatest of difficulty.

Advantages of Chemical Test Methods

Recognition of the difficulties just described has led to the examination of methods which might either overcome or circumvent this sampling obstacle. One of the most promising solutions appears to lie in the application of chemical techniques. Chemical methods, in contrast to physical methods, permit the destruction of the fibre structure and organization; they permit grinding, cutting, mascerating, and dissolving without interference with the chemical results. In other words, they permit the disorganization of the fibre in such a way that mixing is enormously facilitated. From the standpoint of sample variability, a very few chemical results might be expected to give the same degree of precision as a large number of physical results, provided, of course, that the methods are equally sensitive. In this way, a single test could be made to provide a composite result, whereas, otherwise, a result of the same reliability could

only be obtained by extensive computation from a large number of observations. A preliminary examination of some of the chemical methods gives considerable promise of their ultimate usefulness in the evaluation of quality in raw cotton.

Lack of Chemical Studies of Quality in Raw Cotton

Examination of the scientific literature shows that, while the simultaneous chemical and physical changes in *yarns* have been studied quite considerably, almost no comparable studies have been carried out on raw cotton. As early as 1911, Ost [1] suggested the probable utility of the viscosity of solutions of cellulose as a measure of their mechanical strength, but did not develop a practical test procedure. Pliushkin [2] made a few measurements of the viscosity in cuprammonium solution of different grades of cotton and found considerable variation. Clibbens and Ridge,[3] exposed cotton in the form of yarn for various periods to acids and oxidizing agents and noted progressive changes in both physical and chemical properties. They removed and broke individual fibres and expressed the average changes in strength as a percentage of the original strength. A plot of the loss of strength of the fibres against the loss of yarn strength was practically a straight line for both acid and oxidizing attack.

Close Relation of Chemical and Physical Changes in Yarns

In the case of yarns, quite a different situation exists; the close relationship of chemical and physical changes having been well established. Farrow and Neale [4] were two of the earliest investigators to use viscosity measurements of cotton yarns in cuprammonium solution as a measure of damage from acidity or bleaching. Birtwell, Clibbens, Ridge, and Geake,[5, 6, 7, 8, 9] have done much to elucidate the effects of acids, alkalies, and oxidizing agents on the chemical and physical properties of yarns and fabrics. Barr and Hadfield [10] have shown the importance of moisture and oxygen in the deterioration of cotton fabrics by light. Grimes [11] has shown the influence of light on the copper number and strength of white and colored fabrics. Duree and Healy[12] have shown the accelerating action of dyes on physical and chemical deterioration of yarns.

In some cases, chemical methods seem to be even more sensitive to changes than physical methods themselves. For example, in a recent publication of the U. S. Department of Agriculture,[13] data are shown for the influence of ironing temperatures on the strength, copper number, methylene blue absorption, and fluidity in cuprammonium solution, of sheetings manufactured from three different grades of American upland cotton. Part of the data concerning ironing temperatures taken from that publication have been plotted in such a way as to permit comparison of the relative temperatures at which physical and chemical changes occur and are shown here below.

In Fig. 1, the copper number of the sheetings is seen to remain constant as the ironing temperature is raised, until about 255° C. is reached, after which it begins to increase gradually. On the other hand, the physical strength remains constant until about 305° C. is reached, after which it begins to drop. In other words, this chemical test discloses the beginning of damage in the fabric before it can be recognized by the physical method

employed. However, no doubt, this latent damage eventually would become evident in laundering and use.

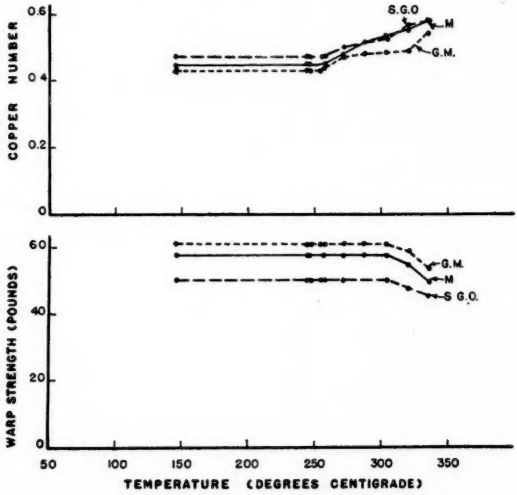

FIG. 1. Comparative behavior at different ironing temperatures of copper number and warp strength of sheetings manufactured from three grades of American upland cotton.

In Fig. 2, the methylene blue absorption also remains constant over the lower temperatures and begins to change, this time to decrease also at about 255° C. In Fig. 3, the fluidity in cuprammonium remains constant at the lower temperatures and starts to shift at approximately the same temperature as the copper number and methylene blue absorption. In each case, the chemical method shows the incipient damage which in the physical test is not yet evident up to 300° C.

Classification of Cottons by Chemical Methods

Reference to the above mentioned three figures discloses another important fact, namely, that at least two of the chemical tests classified the three grades of cotton according to strength. In Fig. 1, the sheeting manufactured from Good Middling cotton has the highest strength and lowest copper number. On the other hand, the sheeting manufactured from the lower grade Strict Good Ordinary cotton has the lowest strength and highest copper number. The sheeting having the intermediate strength gave an intermediate copper number. Obviously, here, the higher copper number is associated with the lower quality of cotton on the basis of strength. This is evident not only in the material exposed to the lower temperatures, but also at the progressive stages of damage.

In Fig. 2, the methylene blue absorptions were practically identical for all three cottons, and not until damage occurred did the cottons arrange themselves in any sequence. However, it is interesting to note that the slight divergences that did appear again tended to arrange the cottons in the order of their quality based on measurements of strength.

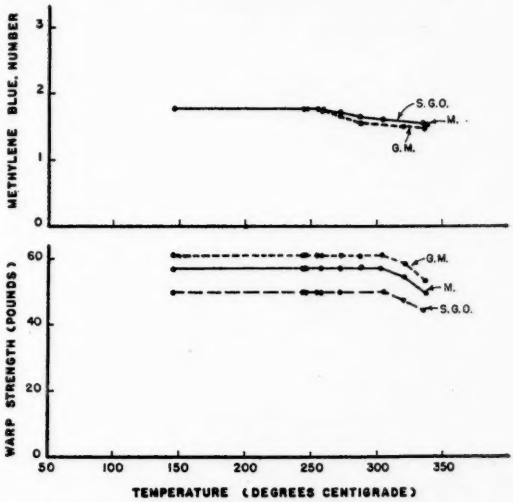

FIG. 2. Comparative behavior at different ironing temperatures of methylene blue absorption and warp strength of sheetings manufactured from three grades of American upland cotton.

In Fig. 3, the cuprammonium reagent again definitely arranges the cottons in the same sequence in almost perfect harmony with the differences that exist in the strength of the sheetings. The fluidities of the manufactured cottons, heated no higher than 150° C., are indicative of their fundamental differences in strength, and it is highly suggestive that similar differences in strength and fluidities would have been observed in the raw cottons, if these had been examined.

In recent years, a new method of testing the strength of raw cotton has been developed in the cotton fibre laboratories of the Bureau of Agricultural Economics. Previous methods based on average breaking load of individual fibres have been defective both in theory and in practice. In theory they have attempted to express the strength of the material without regard to the area of cross section of the fibres, and in practice, Turner and Venkataraman [14] found no relation whatsoever between the mean breaking loads of the fibres of different cottons and the strength of the yarns that could be manufactured from them. Since the size of cotton fibres varies enormously both within and between samples, their average breaking load is no criterion of their strength. In a given count of yarn, there are

not equal numbers of fibres, but a variable number depending on the fineness of the fibre. The special advantage of the improved Chandler bundle method [15] for the determination of strength in raw cotton is traceable primarily to the fact that it expresses the strength of the fibres in terms

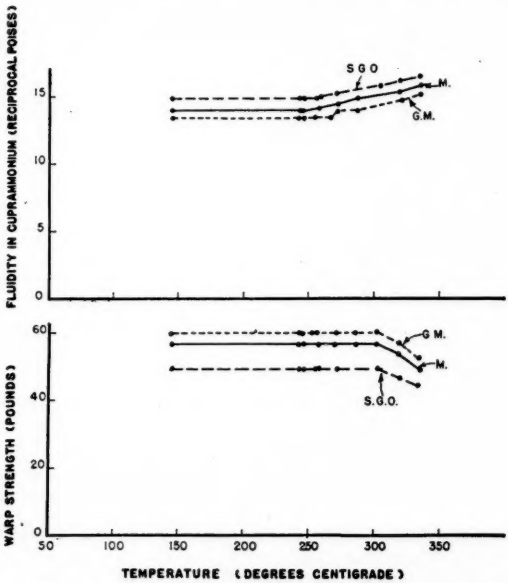

FIG. 3. Comparative behavior at different ironing temperatures of fluidity in cuprammonium solution and warp strength of sheetings manufactured from three grades of American upland cotton.

of unit area of cross section. Practically, the Chandler method gives good correlations between raw cotton and yarn strength. The development of this method has also for the first time made possible the study of raw cotton to determine whether any relationship exists between the chemical properties and the strength.

In Fig. 4, are shown the changes in fluidity in cuprammonium solution of sheetings made from three grades of American upland cotton,[16] before laundering, and after different numbers of times of laundering. The fluidities are plotted against the Chandler bundle strength of the raw cotton. While the scouring and chemicking of the fabric undoubtedly increased the fluidity of the unlaundered sheetings much above that of the raw cotton (note the fluidity figures here in relation to those for raw cotton shown subsequently), the relation of fluidity to strength of the raw cotton is qualitatively, at least, in line with expectation. The higher fluidities are, in general, associated with relatively lower strength. Furthermore, this

relationship is maintained as the strength of the sheetings deteriorates with laundering and wear and the fluidity increases. The difference in quality is seen to be fundamental in the material and not superficial.

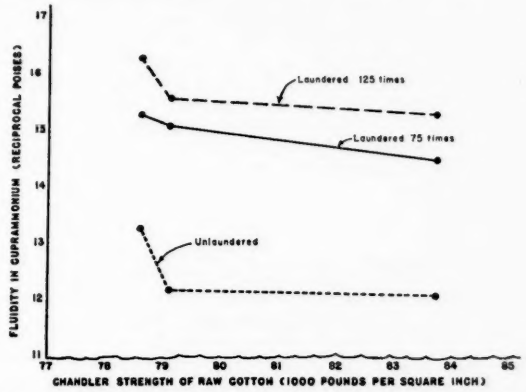

FIG. 4. Fluidity in cuprammonium of sheetings made from raw cotton of different Chandler bundle strength, before laundering and after different numbers of launderings.

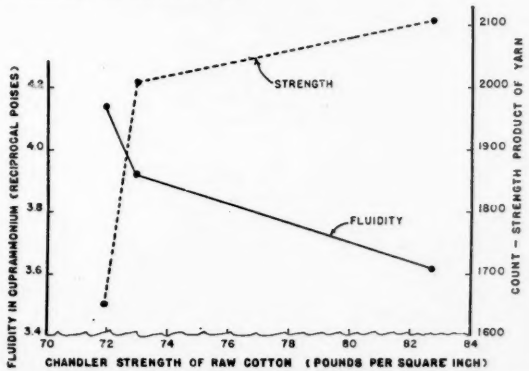

FIG. 5. Comparative fluidities in cuprammonium solution of three cottons of different Chandler bundle strength and corresponding average count-strength products of the yarns manufactured from them.

In Fig. 5, the fluidity in cuprammonium of three other raw cottons is plotted as a smooth curve against their Chandler bundle strength, while the corresponding average of the count-strength products of the six yarns manufactured from each of them is plotted as a broken line against the

Chandler bundle strength. The count-strength products were adjusted to a common staple length * in order to eliminate the variable influence of length. First, it will be noted that the fluidity figures for the raw cotton are much lower than those for the finished fabric shown in the preceding figure. Thus, finishing has been attended by a rather large increase in fluidity values. Available data show that the finishing processes in question resulted in a decrease of 33% in the bursting strength of the finished fabric over that of the grey fabric. Second, the fluidity and count-strength curves are seen to be closely inversely related; *i.e.*, raw cotton of the higher Chandler strength and lower fluidity gave the stronger yarns, while that of the lower Chandler strength and higher fluidity gave the weaker yarns.

In Table 1, are presented the results † of a study of four specially

TABLE 1

Strength and Chemical Characteristics of Four Samples of Raw Cotton

Sample identification	Relative rate of solution in previous study	Chandler bundle strength	Fluidity in cuprammonium solution				Protopectin as calcium pectate	Fats and waxes
			No treatment	Ground	Extracted with carbon tetrachloride	Average		
	Hours	*10^3 lbs./sc. in.*	*Rec. poises*	*Rec. poises*	*Rec. poises*	*Rec. poises*	*Percent*	*Percent*
A	162	111.9	4.01	4.13	4.89	4.34	0.79	0.79
775.757	36	92.0	3.77	4.71	4.11	4.20	0.68	0.65
31	126	82.7	4.46	4.97	4.95	4.79	0.75	0.54
54	54	72.9	4.92	5.42	5.47	5.27	0.85	0.63

selected samples of raw cotton. The strength of the raw cotton varied from 72,900 to 111,900 lbs. per square inch. In an earlier study,[17] the results of which have been presented elsewhere, great difficulty was experienced in dissolving the fibre in cuprammonium solution. The time required for this varied from 36 to 126 hours, with one sample refusing to dissolve even after 162 hours. It was subsequently found that solution could be accomplished in much shorter time by employing the more concentrated cuprammonium reagent recommended by the Cellulose Committee of the American Chemical Society.[18] However, in spite of the long periods required for solution, the earlier fluidity measurements had arranged those cottons which had dissolved in order of their strength. It was, therefore, of interest to determine whether the results obtained with the more concentrated cuprammonium solution would confirm the earlier findings. The

* For this purpose, the formula developed in the Bureau of Agricultural Economics for relating count-strength product of the yarn to count and staple length, was used.

† Grateful appreciation is expressed to Mr. Warren Hastings who performed the chemical measurements.

sample above referred to, which refused to dissolve in the earlier study, was also included.

One criticism that could be brought against the earlier measurements was that noncellulosic impurities are present and may interfere with the accuracy of the results. Consequently, it was decided that in the present study not only should the fluidity of solutions of raw cotton obtained before and after grinding be measured, but also the fluidity should be determined after thorough extraction with carbon tetrachloride. For the purpose of obtaining additional information which might explain the differential rates of solution observed in the earlier study, the quantity of pectic substances and the combined fats and waxes were determined.

Reference to the fluidity results shows that, except for Sample A in two cases, the samples are arranged in each case in order of Chandler strength. In the case of the fibre which was ground, all four samples are arranged in the correct order of strength. The results from the fibre extracted with carbon tetrachloride, however, and the average of all treatments would indicate an interchange in the relative strengths of the two strongest samples. One factor which might possibly be concerned here is that Sample A is from a Sea Island cotton, whereas the others are all from American upland cottons.

Turning finally to a consideration of the pectic substances, experiments showed that none of these were present as either calcium pectate or any pectic acid salt. Rather, they were all present in the form of a protopectin which yielded pectin on acid hydrolysis. In the method used for analysis, the liberated pectin was saponified and converted to calcium pectate for purposes of quantitative determination. From the results, it is seen that in all cases, pectic substances make up less than one percent of the fibre. They do not appear to be correlated with the time for solution in cuprammonium solution. It is interesting to note that the theory advanced by Farr,[19] in which the pectic substances are considered to be entirely responsible for the viscosity of cuprammonium solutions of cellulose, is not supported since the larger percentages of pectic substances are associated with the higher fluidities (lower viscosities).

Finally, the fatty substances do not appear to be associated with either the variations in fluidities or the variation of time required for solution in the earlier study. That they did not interfere with the fluidity measurements seems evident from a comparison of the figures for the samples which were merely ground with those from which the fats were removed by means of carbon tetrachloride. In two of the samples, the results are almost identical before and after extraction. On the other hand, the sample next to the most difficult to dissolve, contained the lowest percentage of fatty substances.

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Formaldehyde as a Protective Agent for Wool*

By FLORENCE BARR and RACHEL EDGAR

Summary

1. *The degradation of a formaldehyde-wool, in one hour at 100° C. by 50 volumes of water, 0.25, 0.50 or 0.75 N hydrochloric acid, in 10 hours at 25° C. by 50 volumes of water or 6 N acid, in 10 hours at 40° C. by 50 volumes of water, 0.05, 0.10, 0.15, 0.20, 0.30 or 0.40 N sodium hydroxide, and in five minutes at 15° C. by 50 volumes of 38% sodium hydroxide, has been measured by the weight, nitrogen, total sulfur, sulfate sulfur, wet strength and elongation at breaking load of the residual keratin after rinsing.*

2. *The formaldehyde-wool lost the same weight, four % less nitrogen, and 17% more sulfur than the wool during one hour at 100° C. in 0.75 N acid. In 0.25 N acid the wool lost 88% and the formaldehyde-wool 56% in wet strength; at 0.5 N these values were 100 and 75.*

3. *The percentage losses by wool (a) and formaldehyde-wool (b) after 10 hours at 40° C. in 6 N acid were: Weight (a, 5; b, 1.4), nitrogen (a, 5; b, 1), total sulfur (a, 0; b, 11), wet strength (a, 75; b, 50).*

4. *Residues of the formaldehyde-wool from 10 hours' treatment in dilute alkali at 40° C. were nearly constant in total nitrogen, greater in weight than those of wool, and of a measurable wet strength at 0.2 N, a concentration four times that beyond which the untreated fabric failed. The non-sulfate sulfur of the residual formaldehyde-wool, a decreasing logarithmic function of the concentration of alkali, $y = axB$, coincided with that of wool at 0.05 and 0.1 N alkali.*

5. *The percentage losses of non-sulfate sulfur, weight, and wet strength in concentrated sodium hydroxide were the same for the formaldehyde-treated as for the untreated wool; the total nitrogen of the formaldehyde-wool was not changed by mercerization.*

Introduction

FORMALDEHYDE was first proposed as a protective agent for wool by Kann in 1903:[16] "If sheep's wool or other ceratinic fibres, that is to say, any kind of animal hair be treated with a solution of formic aldehyde of the formula CH_2O for some time in the cold (or better in the hot) or by the vapours of formaldehyde, and afterwards dried without preliminary washing it will be found that by this treatment the fibre has become much less liable to be affected in the hot by the action of strong

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bases as for instance, caustic alkalies, alkali carbonates, alkali-sulphides, alkaline earths, *etc.*, as well as by the action of steam and of boiling in water of neutral reaction, without diminishing on the whole the useful properties of the wool. The fibre so treated will resist better the action of the said chemicals and will not be shortened or shrunk."

Kann [17] emphasized the elasticity and resistance to alkali of formaldehyde-wool,[19, 18, 15] noted its reaction with nitrous acid, and suggested 0.1 to 0.25% solutions of formalin instead of 4% formaldehyde for protecting wool against alkali without destroying its affinity for dye.

Later patents have cited the use of formaldehyde in fulling [9] and carbonizing wool,[5] carroting hair,[8] and decreasing the affinity of protein for dye.[11]

Bell [6] reported the weight of formaldehyde taken up by a wool increased with the concentration and voume of solution until a maximum of 3% was attained in 30 minutes. He observed a loss of formaldehyde at 100° C. by formaldehyde-wool.

Trotman and Trotman [23] found the resistance to alkali of wool treated with formaldehyde greater than that treated with para-formaldehyde.

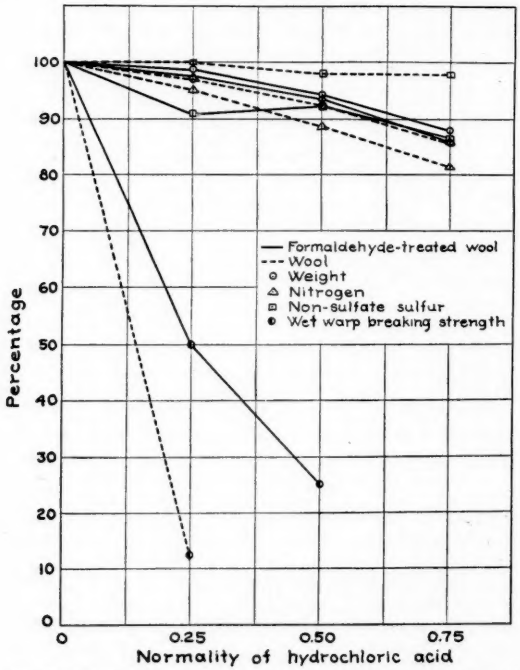

FIG. 1. Effect of hydrochloric acid in one hour at 100° C. on the weight, nitrogen, non-sulfate sulfur, and wet warp breaking strength of wool and formaldehyde-wool.

Trotman, Trotman and Brown [24] have described a formaldehyde-wool of 0.70% formaldehyde and the same total nitrogen as the wool from which it was prepared by heating three hours at 75° C. in 0.6% formaldehyde. This formaldehyde-wool, stable at 100° C. and diazotizable only after decomposition,[12] showed less affinity than wool for water (questioned by Speakman [22]) and neutral-dyeing acid dyes, but greater resistance to deterioration by dilute acid or alkali. It lost 1% nitrogen and 7% weight when boiled twenty to 30 minutes in 1% sulfuric acid, although its total nitrogen was unchanged after four hours at 75° C. in 0.1 *N* sodium hydroxide.

Experimental

Plain-woven wool, boiled one hour in 100 volumes of water, rinsed and dried at room temperature, was cut into five-gram samples and one-inch

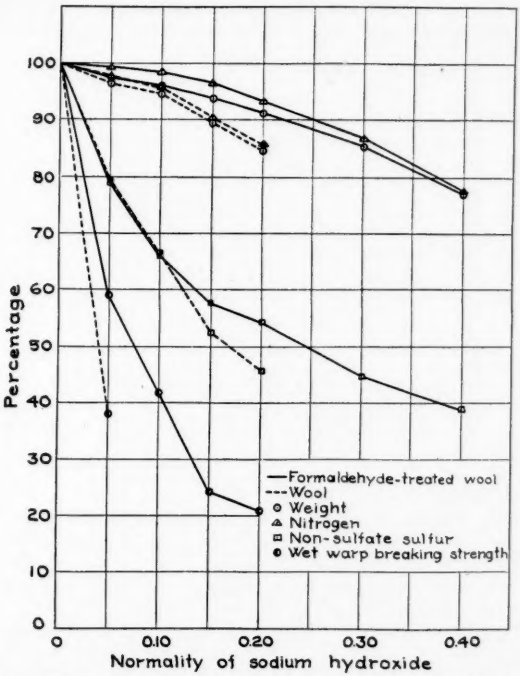

FIG. 2. Effect of sodium hydroxide in ten hours at 40° C. on the weight, nitrogen, non-sulfate sulfur, and wet warp breaking strength of wool and formaldehyde-wool.

strips which were extracted continuously with anhydrous ether for 18 hours and, except strips for breaking strength, dried at 105° C. The weighed

wool was immersed one hour in 50 volumes of 1% formaldehyde[21] in a stoppered flask at 70° ± 0.1° C. and dried in air without rinsing. An analysis of the wool before and after treatment with formaldehyde appears in Table 1.

The formaldehyde-wool was covered with 50 volumes of water or 6 *N* hydrochloric acid (standardized by weighing the silver chloride formed from it) in a stoppered flask at 25° ± 0.1° C. for 10 hours and washed in water until the rinse gave no test for chloride. Degradation at 100° C. in one hour was effected with 50 volumes of water, 0.25, 0.50 or 0.75 *N* hydrochloric acid in a balloon flask fitted with a water-cooled reflux condenser and heated in a boiling water bath.

To test its resistance to dilute alkali the formaldehyde-wool was placed in 50 volumes of water, 0.05, 0.10, 0.15, 0.20, 0.30 or 0.40 *N* sodium hydroxide in a stoppered flask at 40° ± 0.1° C. for 10 hours and washed in water until the rinse failed to color phenolphthalein. The formaldehyde-wool was rinsed in water and centrifuged before it was stirred five minutes in 50 volumes of 38% sodium hydroxide at 15° ±0.1° C.[4] and rinsed free of soluble derivatives by successive liters of water.

The wet strength and elongation of the rinsed fabrics were determined at once,[1] the nitrogen[13] and sulfate sulfur[20] after drying at room temperature, and total sulfur[7, 10, 4] after again drying at 105° C. Each value reported for strength or elongation is the average of ten determinations; values for weight, ash, nitrogen, total sulfur, sulfate sulfur, and sulfite sulfur[14] are the averages of three or more determinations expressed as percentage of the ether-extracted wool dried at 105° to 110° C. until successive weighings with tare differed by less than half a milligram (Figs. 1 and 2). The values for the weight, nitrogen, and non-sulfate sulfur of the untreated wools have been reported previously.[2, 3, and 4]

TABLE 1

Analysis of Wool and Formaldehyde-wool

	Wool	Formaldehyde-wool
Ash (% of wool)	0.05	—
Nitrogen (% of wool)	16.38	16.34
Sulfate sulfur (% of wool)	0.84	0.78
Sulfite sulfur (% of wool)	0	0
Total sulfur (% of wool)	4.62	4.61
Breaking strength of warp (lbs. per inch)		
Conditioned (1)	17	16
Wet	7	7
Elongation at breaking load (%)		
Conditioned (1)	15	15
Wet	48	48

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Abstracts

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I. Fibres (Synthetic and Natural) and Fibre Analysis

Adsorption of Caustic Soda by Cellulose. S. M. Neale. *J. Phys. Chem.*, 1935, V. 39, P. 1345.

Bancroft and Calkin do not emphasize the fact that the concentration of the adsorbed solution removed falls markedly as centrifuging proceeds. This is shown by the author from values derived from Bancroft and Calkin's own data, and would follow if the concentration of free hydroxyl ion in the adsorbed solution is determined by the Donnan equation. (From *Paper Trade J.*, Oct. 1, 1936.) (C)

Anthrax Infection: Prevention of—in Woolen Textile Processing. Ian G. MacDonald. *J. Ind. Hyg. Toxicol.*, 1936, V. 18, P. 357–62.

Formalin vapor for sterilization of the finished product was satisfactory. (From *C. A.*, 1936, V. 30, Col. 6949.) (W)

Carbohydrates and Polysaccharides: Studies on Reactions Relating to. L. Chemical Identity of Cotton and Wood Cellulose. J. Barsha and Harold Hibbert. *J. Am. Chem. Soc.*, June 1936, P. 1006–7; *Paper Trade J.*, Dec. 3, 1936, P. 40. (C)

Casein Wool. Properties and Commercial Possibilities of New Wool Substitute. Paul Larose. *Tex. Col.*, Oct. 1936, P. 697–98. (From *Can. Tex. J.*) (C)

CELLULOSE DERIVATIVES. Ralph E. Montonna. *Paper Trade J.*, Dec. 3, 1936, P. 35–9.

Paper presented at the 90th meeting of the American Chemical Society in San Francisco, Aug. 1935. (C)

CELLULOSE: IMPORTANCE OF CLEARING UP THE CONSTITUTION OF—FOR THE SYNTHETIC FIBRE INDUSTRY. Staudinger. *Mell. Textilber.*, 1937, No. 1, P. 53.

By the examination of rayons and their initial products, determining the degree of polymerization, it is possible to gain an idea of the changes which the cellulose molecules undergo during the production of synthetic yarns or threads by chemical processes. It appears, therefore, to be a simple matter to improve the quality of a given rayon by more highly molecular cellulose which has been chemically broken down to a less extent. The conversion of highly molecular celluloses into rayon yarns, however, presents difficulties in regard to the apparatus, as the author states, because the viscosity of solutions of the same concentration does not rise in proportion to the increase in the degree of polymerization, but much more intensively. These researches are described in detail. Before the rayon industry decides to take up such novel processes, the effect of the relations between fibre strength and molecular length upon the manufacture of rayon must be more closely investigated. (C)

GLUCOSE: APPLICATION IN VISCOSE SPINNING. H. B. Vollrath. *Rayon & Mell.*, 1936, V. 17, P. 244–45, 306–7, 357–59.

The role of glucose (corn sugar) in the spinning operation of the rayon process is summarized in a list comprising 12 points; three of these are regarded as primary: (1) glucose serves to inhibit or retard crystalization of salts on both yarn and machinery; (2) it acts as a buffer against the stringent action of the acid; (3) it deflates or dehydrates the filament as it forms in the spinning bath, and, through a process of osmosis, serves to leach out the impurities. The other points on the list are considered as secondary effects, while some of them have yet to be established. Each point is discussed in detail, especially the first which is considered of the greatest importance. The reasons for selecting corn sugar or glucose as a bath ingredient, and the substitutes which have been suggested, are discussed. The kinds of corn sugar and glucose on the market for use in the rayon industry are described, and typical analyses are given. The properties requisite in a rayon sugar are enumerated and discussed. (From *J. T. I.*, Sept. 1936, P. A419.) (C)

HEMP AND HARD FIBRES. I–IV. *Tex. Mfr.*, 1936, Sept., P. 331–336; Oct., P. 374, 381; Nov., P. 413, 415; Dec., 455, 466. (C)

HOMOGENEITY OF NATIVE CELLULOSES AND THEIR DERIVATIVES. A. Sakostschikoff and D. Tumarkin. *Mell. Textilber.*, 1937, No. 1, P. 57. (C)

HYDROLYTIC CLEAVAGE OF THE DISULFIDE GROUP, A CONTRIBUTION TO THE CHEMISTRY OF KERATIN. Alfons Schöberl. *Collegium*, 1936, P. 412–21; *C. A.*, V. 29, Col. 7281; V. 30, Col. 7349. (W)

JUTE FIBRES: STRENGTH OF. J. B. Martineau. *Tiba*, 1936, V. 14, P. 491–7.

Formalin solns. contg. 10, 50, 75, 100, 150, 200 and 400 g. per l. gave to jute fibres tenacities of 100, 135, 165, 176, 172, 175 and 185, resp. (From *C. A.*, 1936, V. 30, Col. 6569.) (W)

LANITAL—MANUFACTURED WOOL. *Fibre & Fabric*, Dec. 19, 1936, P. 12.

Abstract from the Monthly Bulletin of Agricultural Science and Practice of Rome, Italy. (C)

REGENERATION OF FIBROIN: II. DISPERSION OF FIBROIN. T. Tanizaki. *J. Agr. Chem. Soc. Japan*, 1936, V. 12, No. 4, P. 343–7; *C. A.*, V. 28, Col. 7543; V. 30, Col. 6950. (W)

RESIDUAL MOISTURE IN CELLULOSE DIELECTRICS. E. W. Greenfield. *Franklin Inst. J.*, Sept. 1936, P. 345–58.

The purpose of this contribution is to briefly call attention to the colloidal nature and structure of cellulose, the physical and chemical character of its typical adsorption and finally the behavior to electric stress which is expected to result from such a system exhibiting the properties described. (From *Cotton Literature*, Jan. 1937, P. 20.) (C)

SPUN RAYON: THE MOST VERSATILE TEXTILE FIBRE. Michael Stephens. *Cotton*, Oct. 1936, P. 91–4.

Review of this latest addition to the textile fibre family; it tells the story of what it is, how it is being used, some of the problems involved, and some of its prospects. (C)

WOOL: STUDY OF. Haller. *Mell. Textilber.*, 1937, No. 1, P. 5.

The author has already described in a former article how wool can be broken up into its histological components by treatment with a solution of ammonia. In the present article he describes more recent experiments in which he made use of a proteolytic enzyme for breaking up wool into its components. In this case also it was found that wool breaks down into a large number of spindle-shaped cortical cells, which indicates that the lanain, the cementing substances of the cortical cells, had been dissolved by the enzyme. (C)

X-RAY STUDIES OF CRYSTALLITE ORIENTATION IN CELLULOSE FIBRES. II. SYNTHETIC FIBRES FROM BACTERIAL CELLULOSE MEMBRANES. W. A. Sisson. *J. Phys. Chem.*, 1936, V. 40, P. 343–59; *Paper Trade J.*, Dec. 3, 1936, P. 40. (C)

II. YARNS AND FABRICS

ACETATE AND VISCOSE YARN RELATIONS. *Am. W. & C. Rptr.*, Aug. 20, 1936, P. 7–8, 39.

Sufficient variations are shown in properties of similar yarns to indicate desirability of controlled testing when selecting yarns for particular purposes. (C)

BLEACHED WOVEN AND KNITTED COTTON FABRICS CHANGING TO YELLOW. Walter Bruckhaus. *Spinner u. Weber*, 1936, V. 54, No. 24, P. 9–11.

While pure cotton fabrics will turn yellow only very slowly this change in color is hastened greatly if certain contaminations are present such as alkalies, Fe compds., fats, resins, etc. The degree of purity of cotton and its storage quality can be tested by (1) boiling a sample with dil. NaOH, (2) moistening a spot of the material with dil. NaOH or NH_3 and (3) subjecting the sample to steam. Another factor is the chlorination bleach of the cotton. Too long an exposure to Cl or too high a concn. may bring about the superoxidation of cellulose and may cause the material to become yellow. The yellow color may also be caused by treatment with soaps made from unsatd. acids, mineral oils, water contg. Fe, salts and oxides of Mn, the action of acid vapors or baths on fabrics bleached with ultramarine, excessively hot drying, ironing, calendering, etc. The presence of aniline vapor may change the white tint to pink. (From *C. A.*, 1936, V. 30, Col. 5421.) (W)

CHEMISTRY OF SILK AND SILK PROCESSING: DEVELOPMENTS DURING 1935 IN THE. Walter M. Scott. *Am. Dye. Rptr.*, Aug. 24, 1936, P. 451–6, 475–6.

A review with bibliography. (C)

DRYING OF WOOL AND WOOLEN FABRICS. Hubert Krantz. *Spinner u. Weber*, 1936, V. 54, No. 23, P. 9–15.

A lecture dealing with the effect of temp., moisture and air current and reviewing various drying machines. (From *C. A.*, 1936, V. 30, Col. 5799.) (W)

DRYING OF COTTON. P. B. Wendler. *Am. W. & C. Rptr.*, July 30, 1936, P. 40–1; *Tex. Rsch.*, June 1936, P. 359–60.

Paper read at conference on Drying Problems under auspices of U. S. Institute for Textile Research in New York City, May 6, 1936. (C)

DRYING OF SILK HOSIERY. Erb N. Ditton. *Am. W. & C. Rptr.*, June 4, 1936, P. 9–10; *Tex. Rsch.*, June, 1936, P. 366–69.

Paper read at conference on Drying Problems under the auspices of U. S. Institute for Textile Research in New York City, May 6, 1936. (C)

DRYING TEXTILE FIBRES AND FABRICS. Lucien Buck. *Am. W. & C. Rptr.*, June 18, 1936, P. 7–8, 16; *Tex. Rsch.*, June, 1936, P. 373–78.

Paper read at conference on Drying Problems under the auspices of U. S. Institute for Textile Research in New York City, May 6, 1936. (C)

EVALUATION OF TEXTILE STARCH. W. Seck. *Mell. Textilber.*, 1934, V. 15, P. 368–71.

A crit. discussion of H_2O, ash and η detns. (From *C. A.*, 1936, V. 30, Col. 2766.) (W)

FABRICS: SPECIFIC STRENGTH. S. Kjellstrand. *Leipz. Monats. Tex. Ind.*, 1935, V. 50, P. 254–57, 278–80; *C. A.*, 1936, V. 30, Col. 2765.

The relations between fibre, yarn and fabric strengths are discussed and it is shown that the strength of a fabric of high yarn density is practically independent of the twist and irregularity of the constituent yarns and bears no close relation to the strength of the yarns but is dependent on the strength of the fibres. For such fabrics it is possible to determine a specific strength which is independent of the area of cross-section of the fabric. The results of tests on various cotton and woolen fabrics are given. When the yarn density is below certain limits the specific strength of the fabric varies with the yarn density. The highest value of the specific strength is termed the saturation strength and the two strengths are related according to the formula specific strength $= k \times$ saturation strength, where k varies with the yarn density and the nature of the fibre. A formula for the calculation of the absolute strength of a fabric from the specific strength is given and the relations between the specific fabric strength and the properties of the fibres are discussed. It is shown that in the case of cotton fabrics comparisons of the specific fabric strengths provide a more convenient basis for the comparison of the quality of the cotton used than determinations of hair length, fineness and strength. (From *J. T. I.*, April 1936, P. A181.) (C)

FADING BY GLARE. Harry H. Klein. *Tex. Wld.*, July 1936, P. 74.

It is indicated that glare is a factor which must be taken into consideration in determining the fastness of dyes on cellulose acetate. As used in this article, the word "glare" is defined as light reflected from a glossy painted surface (C)

FAULTY RAYON CRÊPES: CAUSES OF—FOUND IN IMPROPER THROWING. Ernest H. Doute. *Rayon & Mell.*, June 1936, P. 63–4. (C)

FLAX FIBRE ULTIMATES: SOME OBSERVATIONS ON THE SIZE AND SHAPE OF. E. Slattery. *J. T. I.*, April 1936, P. T101–8.

Strands of two kinds of flax of widely different origins have been examined for ultimate weight per centimetre, length, width and diameter at the root, centre and top, after relieving them of their extraneous matter. Full details of the experimental methods and references are given along with a necessary precaution in making observations on the ultimate fibre cross-section. The work done shows that the ultimates vary in width, diameter, and weight/cm. progressively up to the strand, the greatest width, diameter and weight/cm. being at the root end. (C)

FULLING AND FELTING OPERATIONS: THEORY AND PRACTICE OF. Ludwin Geisser. *Deut. Wollen-Gewerbe*, 1936, V. 68, P. 335–9; *C. A.*, 1936, V. 30, Col. 3653. (W)

FULLING THEORY. M. Loescher. *Deut. Wollen Gewerbe*, 1936, V. 68, P. 476–8.

The migrating theory as applied to the fulling and felting process is critically discussed. Reply by R. Brauckmeyer, *Ibid.*, P. 478–9. (From *C. A.*, 1936, V. 30, Col. 4012.) (W)

LUBRICANTS AND LUBRICATION OF TEXTILE FIBRES. E. West. *J. Soc. Dyers Col.*, 1935, V. 51, P. 211–15. W. E. Boswell. *Ibid.*, P. 215–18.

An outline is given of the technic of fibre lubricants for knitting yarns. The reasons for, and effects of, oiling are discussed, and the desirable properties of suitable materiols (oils, waxes) for the process are examd. (From *C. A.*, 1936, V. 30, Col. 3244.) (W)

MILLING AND FELTING: THEORY AND PRACTICE OF. R. Brauckmeyer. *Mell. Textilber.*, 1936, V. 17, P. 31–4; 205–8.

Witt's theory, which explained the felting effect of wool as due to the linking together of the scales by means of their edges is not correct. The characteristic appearance of every finished felt is that of a confused mass of wool fibres entangled with one another, a condition produced by reason of the pressure and beating involved in the milling process, which cause the hairs to move with their root ends foremost. The scales do not link together, but merely prevent retrogression of the hairs. Mechanical alterations which occur during milling include thickening of the material in both warp and weft, and release of the tension. Milling can also be explained on the grounds of the present author's felting theory, provided that the peculiar properties of the wool fibre, particularly in the damp condition, are taken into account. Soap functions in the milling process firstly as a lubricant to reduce friction between the hairs themselves and the machine parts, and secondly to bring the wool into the most favorable condition of swelling. The poor felting properties of shoddy and chlorinated wool are due, mainly, to their low swelling capacity. The possibilities of developing artificial fibres, capable of felting, are discussed. (Copied from *J. Soc. Dyers Col.*, May 1936, P. 195.) (C)

MOISTURE CONDITION OF RAYON YARNS. *Tex. Mfr.*, June 1936, P. 211.

The affects of fluctuating atmospheric condition on the package shape of viscose yarn. Copied from recommendations of Courtaulds (Canada) Limited Technical Service published in the *Canadian Textile Journal.* (C)

MOTHPROOFING MATERIALS: A THIRD INDEX OF PATENTED. R. C. Roark and R. L. Busbey. *U. S. D. A. Bur. Entomol. Plant Quarantine*, Feb. 1936. 104 pp.

About 500 materials are listed alphabetically. Assignee and patentee indexes and a numerical list of patents are given. (From *C. A.*, 1936, V. 30, Col. 2392.) (W)

NEPPINESS IN WORSTED YARNS: DETERMINATION OF. H. J. Henning. *Textilber.*, 1935, V. 16, P. 850–51; *J. T. I.*, April 1936, P. A180.

An earlier apparatus (*Textilber*, 1935, V. 16, P. 710–12, 761–65, also *J. T. I.*, 1936, P. 130) for the photoelectric measurement of levelness of yarns is adapted to determine the frequency of occurrence of neps in a worsted yarn. The modifications involved are very simple. (C)

OILING OF STAPLE RAYON IN THE WOOL—AND COTTON-SPINNING MILL. Sauter. *Monatschr. Textil-Ind.*, 1936, V. 51, Fachheft I, P. 4–5; *C. A.*, 1936, V. 30, Col. 4328. (W)

PERMANENT FINISHES: USE OF VISCOSE SOLUTIONS IN TREATING COTTON FABRICS TO PRODUCE. John T. Gibbons. Tex. Wld., July 1936, P. 88. (C)

PERMEABILITY OF AIR AND MOISTURE THROUGH IMPREGNATED FABRICS. Bundesmann. *Z. ges. Textil-Ind.*, 1936, V. 39, P. 128–30.

Textile fabrics which have been impregnated to be impervious to moisture should still be penetrable to air. Expts. show that this is possible and that there is no relationship between the permeabilities of air and moisture through such fabrics. (From *C. A.*, 1936, V. 30, Col. 3242.) (W)

PRESERVATION OF FISHING NETS BY TREATMENT WITH COPPER SOAPS AND OTHER SUBSTANCE. III. W. R. G. Atkins. *J. Marine Biol. Assoc. United Kingdom*, 1936, V. 20, P. 627–41; cf. *C. A.*, V. 24, P. 6025.

For five years nets have been permitted to rot in glass jars and under the Plymouth Pier in sea water. The preservatives tried included coal-tar products such as tar, creosote, phenols, wood distn. fractions, petroleum fractions, cutch varieties and various Cu soaps. The cutch varieties included one ext. from the heartwood of the Quebracho tree and one from the bark of the South African mimosa. The treatment with cutch and Olies' $CuNH_4$ sulfate is better than the old cutch-dichromate method. Tar and Cu naphthenate were also effective. Silk plankton nets can be preserved with a dil. soln. of Cu naphthenate and tar made up in gasoline. Fish lines are also made more durable by such treatment. The rate at which the Zn or Cu preservatives are lost to water can be estd. by the addn. of Na diethyldithiocarbamate reagent to the water. (From *C. A.*, 1936, V. 30, Col. 3653.) (W)

RAYON AND STAPLE FIBRE YARNS: TESTING THE UNIFORMITY OF. P. A. Koch. *Mell. Textilber.*, 1936, V. 17, P. 123–27.

Examination of the uniformity of various rayon and staple fibre yarns by means of the Gleifometer, has indicated that uniformity is influenced considerably by the fineness of the filaments. In coarse filaments, variations in the shape of the cross-section, as far as fibres of approximately circular cross-section are concerned, have a direct influence on the uniformity of the yarns. The particular spinning process used in the manufacture of spun yarns from staple fibre, alone or mixed with other fibres, has a considerable influence on the Gleifometer diagrams. (Copied from *J. Soc. Dyers Col.*, May 1936, P. 191.) (C)

RAYON DRYING. Dr. F. Bonnet. *Tex. Bull.*, June 18, 1936, P. 12–13; *Tex. Rsch.*, June, 1936, P. 363–66. *Rayon & Mell.*, June 1936, P. 54–5; *Am. S. & R. J.*, Aug. 1936, P. 21–2, 42.

Paper read at conference on Textile Drying, sponsored by U. S. Institute for Textile Research. (C)

RAYON: NEW METHODS OF THE MANUFACTURE OF. PRODUCTION OF RAYON FROM NATURAL SILK WASTES. Freitag. *Monatschr. Textil-Ind.*, 1936, V. 51, P. 17; *C. A.*, 1936, V. 30, Col. 2390. (W)

III. Chemical and Other Processing (Not Otherwise Classified)

Acid Fulling of Cloths. A. Duranson. *Tiba*, 1936, V. 14, P. 247–9.

The influence of the concn. of acids is described. All acids give better results than soap fulling. Fulling is greatest with H_2SO_4 and least with AcOH. While the contraction is nearly equal when using HCO_2H, HCl and AcOH, it is much greater with H_2SO_4. The difference in elasticity is less accentuated than tenacity but the order is the same. (From *C. A.*, 1936, V. 30, Col. 6203.) (W)

Colloid Mill in the Paper Industry. H. L. Bullock. *Paper Trade J.*, Aug. 27, 1936, P. 30–3.

Also describes a number of uses in the textile industry. (C)

Condensation of Dyes in (Textile) Fibres. E. Schupp. *Monatsh. Seide Kunstseide*, 1936, V. 41, P. 219–24.

After a detailed review of the literature S. concludes that all types of dyes tend in greater or less degree to become condensed at the surface of the fabric. Dyes which are usually considered to be fixed within the fibre nevertheless possess a certain mobility which allows them to pass through the cell wall which represents 1/3–2/3 of the whole diam. of the fibre. This condensation can be utilized to explain certain phenomena in dyeing and printing operations. Furthermore the phys. condensation of dyes is a means a sepg. mixed dyeings into their components and identifying the latter. It can also be employed as a method of studying the histological behavior of various textile fabrics. Some evidence is given to show that it is possible to conclude from the pos. or neg. result of the condensation process whether the dye is held by adsorption or whether it has formed a chem. compd. with the fabric. (From *C. A.*, 1936, V. 30, Col. 5794.) (W)

Cotton Dyes: Identification of—on the Fibre. Maurice Robinet. *15me Congr. chim. ind. (Bruxelles, Sept. 1935)*, 1936, P. 640–6.

The method of Zanker and Rettberg (*C. A.*, V. 27, P. 1181) for the detn. of dyes on cotton should be modified as follows: make the washing test at 60–70°; whether the sample bleeds or not, subject it to the tests for S dyes, taking the usual precautions; the distinction between direct cotton dyes and basic dyes should be based on the behavior of the dyes in presence of wool. (From *C. A.*, 1936, V. 30, Col. 5794.) (W)

Decomposition of Perborate Bleaching Baths. Kehren. *Z. ges. Textil-Ind.*, 1936, V. 39, P. 370–1.

Modern perborate bleaches are very stable and give off the active O only very slowly if used properly. Decompn. is slower in hard than in soft water because of the stabilizing effect of Ca and Mg salts. Com. liquid H_2O_2 bleaches must contain a stabilizer on account of its ease of decompn.; this is unnecessary in solid perborate bleaches. Water glass does not affect the stability of bleaches in distd. water; in hard water it has a stabilizing effect due to formation of Ca and Mg silicates. The stability of an O bleaching agent is decreased by increasing alky. of the bath. The more alk. the bath the smaller its stability. Since bleaching

follows prewashing with soap and soda without rinsing the bath is always somewhat alk. in practice. (From *C. A.*, 1936, V. 30, Col. 5420.) (W)

DYED CELLULOSE ACETATE MATT SILK: INFLUENCE OF BLEACHING AND DYEING CONDITIONS ON LIGHT FASTNESS OF. J. Rolland. *Tiba*, 1934, V. 12, P. 927–9.

All traces of SO_2, used, *e.g.*, for removing MnO_2 formed in the $KMnO_4$ bleach, must be destroyed. $H_2C_2O_4$ is suitable for removing MnO_2. (From *C. A.*, 1936, V. 30, Col. 5421.) (W)

DYEING AND FINISHING BEMBERG RAYON: SUGGESTIONS FOR. E. Higgs. *J. Soc. Dyers Col.*, 1936, V. 52, P. 209–10; *C. A.*, 1936, V. 30, Col. 5796. (W)

DYEING CELLULOSE ACETATE FIBRES. J. A. Wallwork. *J. Soc. Dyers Col.*, 1935, V. 51, P. 415–6.

Typical methods for the dyeing of developed colors on acetate rayon are described. *E.g.*, the material is padded with the color base and subsequently entered into the naphthol bath. (From *C. A.*, 1936, V. 30, Col. 5796.) (W)

DYEING FAST-TO-LIGHT SHADES ON JUTE YARN. H. Hausmann. *Tex. Col.*, 1935, V. 57, P. 820–2, 852; *C. A.*, 1936, V. 30, Col. 5796. (W)

DYEING OF LOOSE WOOL WITH RHODAMINE DYES. J. Winfield. *Dyer*, 1935, V. 73, P. 413–4.

Basic Rhodamine 6G, 3B and B dyes yield deeper, brighter and faster-to-fulling (with soap) shades when applied from an acid instead of a neutral bath, especially if H_2SO_4 is used instead of AcOH or HCO_2H. Fe in the acid dye liquor dulls the resulting shade considerably. Slightly duller but faster-to-fulling shades are obtained with acid Rhodamine dyes. (From *C. A.*, 1936, V. 30, Col. 5795.) (W)

DYEING OF SPANGLED YARNS. Francois Rony. *Tiba*, 1936, V. 14, P. 89–93, 159–65; *C. A.*, 1936, V. 30, Col. 6201. (W)

DYEING RAW WOOL. A REVIEW OF MODERN METHODS IN THE DYEHOUSE. L. N. Swann. *Tex. Rec.*, 1936, V. 53, P. 33, 35; *C. A.*, 1936, V. 30, Col. 5417. (W)

DYEING WOOL AT LOW TEMPERATURES: MODERN METHODS OF. Ed. Justin-Mueller. *Tiba*, 1936, V. 14, P. 165–7.

The processes of the Imp. Chem. Industries are compared with those of Rodon and Font. (From *C. A.*, 1936, V. 30, Col. 6201.) (W)

ENZYMES: ROLE OF THE—IN THE TEXTILE INDUSTRY. Hans-Joachim Henk. *Monatschr. Textil-Ind.*, 1936, V. 51, P. 157; *C. A.*, 1936, V. 30, Col. 6202. (W)

FATTY ALCOHOL SULFONATES: USE OF—IN HOT BATHS. P. Wilhelm. *Monatschr. Textil-Ind.*, 1936, V. 51, P. 134–5.

The fatty alc. sulfonates can be employed more generally than soaps; they can be used in baths contg. acids and salts. The gardinols are ex-

amples of this type. Lanaclarin and Oxycamit are sp. fatty solvent combinations. A sp. product for bleaching purposes is Ondal which liberates O, thus acting as a detergent as well as a bleaching agent. As the neutral fatty alc. sulfonates do not hydrolyze even at elevated temps. the textile material can be subjected to a more intensive treatment. The following finishing operations which are usually carried out in hot baths are discussed; precleaning, dyeing, after-soaping, bleaching and stripping. (From *C. A.*, 1936, V. 30, Col. 5800.) (W)

FLUORESCENCE OF ACRIDINE DYES ON SILK AND RAYON. Maurice Déribéré. *Rusta*, 1936, V. 11, P. 219, 221; *C. A.*, 1936, V. 30, Col. 6199. (W)

FOULARD DYEING. Michel Kissileff. *Tiba*, 1935, V. 13, P. 619–25, 693–9, 761–7.

Photographs of dyeing machines are shown. Typical baths and math. dyeing formulas are described. Tables are given on exhausting tests with indigosols. A control scheme in the exhausting of the foularding bath, by means of a photo-elec. cell, is presented. (From *C. A.*, 1936, V. 30, Col. 5796.) (W)

HYDROGEN-ION: USES OF THE—CONCENTRATION IN THE TEXTILE INDUSTRY. Heinrich Walland. *Monatschr. Textil-Ind.*, 1936, V. 51, P. 101–3, 132–4; *C. A.*, 1936, V. 30, Col. 5418.

A review with many references. (W)

LINEN: STUDY OF SOME NEW METHODS FOR BLEACHING, DYEING AND FINISHING OF. G. Guyot. *Rev. gén. mat. color.*, 1936, V. 40, P. 212–7.

Kind and Korte's process is discussed as well as the use of a dispersing agent to permit dyeing in other ways than in skeins and to permit the use of naphthols, vats and indigosols. The Belgian method for dyeing linen cloth is described. (From *C. A.*, 1936, V. 30, Col. 5421.) (W)

LUSTERING OF NATURAL SILK. P. Hazard. *Rusta*, 1936, V. 11, P. 283.

A brief outline of the 3 main processes of lustering silk; calendering, treatment with HCO_2H, impregnation with cellulosic varnish. (From *C. A.*, 1936, V. 30, Col. 6204.) (W)

MERCERIZATION OF MIXED FABRICS FROM COTTON AND STAPLE RAYON: PROBLEM OF. H. Rath, Kuile and Jäger. *Z. ges. Textil-Ind.*, 1936, V. 39, P. 357–9, 371–2.

Under the action of NaOH regenerated cellulose undergoes a reversible reaction; native cellulose is changed to hydrated cellulose. The equivalence ration $2(C_6H_{10}O_5)\cdot NaOH$ was reached with native cellulose at a concn. of NaOH of approx. 15% and with the regenerated cellulose at about 10%. The amt. absorbed depends on temp., kind and history of cellulose used. Swelling and shrinking properties of the two celluloses are discussed and curves are given showing their solubilities in NaOH. The commonly used NaOH concn. of 27–30° Be. and the usual time of immersion may be retained in mercerization of the mixed fabrics. The

temp. of the rinsing water should be as high as possible so that the max. of the soly. of staple rayon would be reached at the highest temp. and thus the lowest soly. tension. Rinsing should be carried out very rapidly as in the crit. concn. the soly. increases with time. The temp. of the alkali should be detd. according to the percentage compn. of the mixed fabric. Fabrics with high contents of staple rayon (50%) should be mercerized at 25–30°; at lower contents the temp. may be decreased. The results are given for the mercerization of a no. of different mixed fabrics. (From *C. A.*, 1936, V. 30, Col. 5420.) (W)

IV. Research Methods and Apparatus

Control of Processing: "Multelec" Recorder for pH, Temperature, CO_2, etc. George Kent Limited, Luton. *Tex. Mfr.*, Dec. 1936, P. 471–72.

A new recording instrument for use of pH, temperature, CO_2 in flue gases, electrolytic conductivity, etc., and can be used as an automatic control instrument. (C)

Cuprammonium Viscosity: Standard Method for the Determination of the. Note No. 12. Faserstoff-Kommission. *Papier-Fabr.*, Apr. 12, 1936, P. 113–17.

An illustrated and detailed description is given of the apparatus and procedure used by the German standard method for determining the cuprammonium viscosity of cellulose. (From *Paper Trade J.*, Dec. 24, 1936.) (C)

Evenness of Yarn: On the Measurement of. H. Mori. *J. Soc. Tex. Ind. Japan*, July, 1936, P. 368; *Rayon Tex. Mo.*, Dec. 1936, P. 84.

The author experiments on the measurement of evenness of yarn in three different ways, namely (1) suction yarn guide tube method, (2) caesium photo-cell method and (3) photo-voltaic cell method, all the apparatus having been designed and constructed in his laboratory. (C)

Laboratory and the Control of Uniformity of a Textile Product. *Rayon Tex. Mo.*, Dec. 1936, P. 39–40. (C)

Microscopy of Rayon Filaments. Fred A. Mennerich. *Am. Dye. Rptr.*, Dec. 28, 1936, P. 726–8. (C)

pH Measurement in the Paper and Pulp Industry. Kurt Schwabe. *Papier-Fabr.*, Spec. No., June 1936, P. 24–36.

The most comprehensive discussion of pH, pH measurements and pH application in the pulp and paper industry, yet published. After discussing the theory of pH, the three methods of measuring pH are described in detail, namely; the colorimetric, electric potentiometer and the catalytic action on certain reactions which can be observed. (From *Paper Trade J.*, Dec. 24, 1936.) (C)

PHOTO-CELL: APPLICATION OF—IN MANUFACTURE OF KNIT GOODS. W. Hildebrandt. *Rayon Tex. Mo.*, Dec. 1936, P. 61–4.

Describes principles of the photo-electric cell, its textile possibilities in general and those of its application in the knit goods industry. (C)

RESISTANCE OF SOLID SURFACES TO WETTING BY WATER. Robert N. Wenzel. *Rayon Tex. Mo.*, 1936, Nov., P. 63–4; Dec., P. 73–4. (C)

TESTING OF FIBRES, SPUN YARN AND FABRICS. W. Kumichel. *Papier-Fabr.*, Jan. 12, 1936, P. 9–14.

Tentative standard methods for the testing of textile fibres, spun yarn and fabrics are given in detail. (From *Paper Trade J.*, Dec. 24, 1936.) (C)

TEXTILE INDUSTRY INTERPRETS RESEARCH. II. SOME FUNDAMENTAL CONCEPTS OF TEXTILE PHYSICS. E. R. Schwarz. *Rayon Tex. Mo.*, Dec. 1936, P. 37–8, 53. (C)

UNIFORMITY: IMPORTANCE OF—IN THE CONSTANT RATE OF LOADING WITH THE SCOTT INCLINE PLANE SERIGRAPH. A. Stuart Hunter. *Rayon Tex. Mo.*, Dec. 1936, P. 59–60.

Conclusions: We have demonstrated that in testing rayon yarns a *machine factor* still exists—even in the incline plane tester. If one is forced to change the machine capacity, in order to accommodate samples of different sizes or strength, objectionable machine influences interfere with the most exact registration of yarn properties. We have described a partial remedy for this situation which calls for testing all yarns under a common rate of loading per unit size per unit time. Specifically, we have found that a rate of 4 grams per denier per minute constitutes a rate of loading which minimizes machine influences and which gives a stress-strain curve of such a shape that the yield points of a yarn may be reasonably estimated.

While we have not acquired extended data on silk and wool, we believe that these yarns will behave similar to rayon, if uniformity in the constant rate of loading is not maintained. The ideal time to work out a system for use of any given new instrument is before that equipment goes into general distribution. We draw your attention to our experience with the incline plane tester in the hope that our findings may be of assistance in avoiding confusion, which we expect would result should these machine influences not be recognized and taken care of in future testing. (C)

WOOL: STANDARDIZATION OF THE MEASUREMENT OF THE FINENESS OF—BY THE INTERNATIONAL WOOL ASSO. E. Franz. *Mell. Textilberichte*, 1936, P. 625; *Rayon Tex. Mo.*, Dec. 1936, P. 84.

The International Wool Conference has decided upon international regulation of the measurement of the fineness of wool and the author gives a connected account of the origin of the technical methods prescribed. (C)

WOOL: STUDIES ON DETERMINATION OF SULFATE AND SULFURIC ACID ON. Alban Eavenson and Jos. W. Creely. *Am. Dye. Rptr.*, Dec. 28, 1936, P. 719–22, 732.

A quick method for determination of sulfuric acid on wool, sufficiently accurate for mill control work is presented, with some observations on the

rate of removal of sulfuric acid, sodium sulfate and sodium acid sulfate. Some precautions to be observed in gravimetric determinations of sulfuric acid are noted. (C)

V. Economics, Physics and Miscellany

Color Problems in the Paper Industry: Recent Progress on. Lester C. Lewis. *Paper Trade J.*, Nov. 26, 1936, P. 43–50.

Only recently have several powerful techniques been brought into active use in the industry, so that new results and still greater efficiencies in the use of color are both being obtained, and to be predicted for the near future. The techniques are: (1) Spectrophotometry, particularly with recording instruments. (2) Grading (intelligent use of spectrophotometry). (3) Calculation of results by the theories of light in diffusing media. Presented at the Conference on Color, Mass. Institute of Technology, Cambridge, Mass., July 23–5, 1936. (C)

Book Reviews

1935–36 Year Book of American Association of Textile Chemists and Colorists. Howes Publishing Co., New York, N. Y. Pp. 570. To non-members, $3.00.

This is the thirteenth edition of this standard reference book for textile chemists, and those engaged in allied work. Reports of research committees show notable progress, particularly those of its sub-committees on dye fastness, and on the chemistry of wool. The tables of American dyes, arranged alphabetically and by color index numbers have been brought up to date, as has been the alphabetical list of textile chemical specialties. A notable and valuable new feature is the section devoted to analytical methods for textile chemical laboratories; it is based upon methods originally collected by Chm. W. M. Scott of the sub-committee on analytical methods. Lists of members are arranged both alphabetically and geographically, and as of the date of publication numbered 1,658. (C)

Textile Design as an Occupation. Federated Council of Art Education, New York, N. Y., and Institute of Women's Professional Relations, Washington, D. C. Pp. 48. Price, 40 cents.

A reasonably clear and accurate review of the domestic textile industry as an occupational field for the artist designer. While the frontispiece of the booklet shows a printed silk which was designed by a high school girl, the authors paint a picture of the qualifications of a successful textile designer that is rather uninviting. They are correct in listing among the essentials technical knowledge of processes, materials, weaves, finishes, of color in relation to the latter, of markets, of style and style trends, etc. In addition they indicate average wages no higher than those of skilled weavers. The booklet is recommended to manufacturers who have been hesitating to employ artist designers or buy their designs, believing the expense would be prohibitive. The Textile Foundation contributed to the cost of printing this booklet, and copies may be obtained by addressing the Secretary, Commerce Bldg., Washington, D. C. (C)